

tion against a set of criteria and then establishes the local group distribution networks as virtual islands prior to potential necessity for such consideration. It will be understood that further benefits flow from consideration of the network at both a local and main distribution network level. By such local network and main distribution network consideration even though the method of control in accordance with aspects of the present invention may not actually establish an island itself or need to establish such local group distribution networks as islands the controller will nevertheless provide an indication as to stress within the main distribution network which may be remedied appropriately. During virtual islanding local group distribution networks will generally reduce electrical power exchange with other parts of the main distribution network dependent upon the grade of islanding required by the divergence from the set of criteria. Clearly, if it is envisaged that a island will be established then the net exchange from the local group distribution network in terms of a virtual island to the remainder of the main distribution network will be almost zero. Furthermore, the controller and the method will provide voltage support to the local group distribution network and in such circumstances the main distribution network may export or import VARs as required to maintain nominal line voltage with possible adjustments to maintain a non-zero VAR flow to optimise the performance of islanding-detection relays.

[0032] If the local group distribution network when considered as a virtual island is adding to net electrical power demand within the main distribution network prior to determining and establishing of a virtual islanding state then this dependence can be reduced progressively under the control and methodology as described above by the controller to an almost zero demand from the local group distribution network to the main distribution network. Such reduction can be achieved whilst maintaining voltage and maintaining synchronisation between the local group distribution network as an island with the main distribution network. By such an approach it will be understood that stability within the main distribution network is maintained without drawing or adding electrical power to it. Such an approach as indicated above is particularly advantageous when considered as a ballast in establishing the local group distribution network as a virtual island and may enable the main distribution network to remain operational in situations where the divergence from the set of criteria would have led to collapse or degradation. In essence the virtual island defined by the local group distribution network will remove potential perturbations within the main distribution network to allow that main distribution network to continue operationally. The local group distribution network as a virtual island in such circumstances may substantially quarantine potential problems or excesses within the main distribution network for maintenance, repair or analysis.

[0033] As described above the establishing of virtual islanding in stages whilst the local group distribution network in terms of power sources and power loads remain practically connected to the main distribution network allows local analysis of the local group distribution network. In such circumstances problems with regard to power quality within the local group distribution network, or virtual island, can be addressed and corrected. Once the problems in power quality within the virtual local group distribution network, or virtual island, have been resolved it will be understood that problems with regard to such power quality will have less effect upon a

main distribution network which is weak. It will also be understood that if the main distribution network is broken into at least a number of local group distribution networks which can be considered in virtual islanding states then the action of the virtual islanding method and application of a controller as described above will enable the entire main distribution network to typically maintain a performance above a level at which islanding is required. It will be understood if the whole of the main distribution network must maintain a certain level of performance a rogue local group distribution network may cause a sufficient deviation from the set of criteria whether that be voltage, frequency or current or fluctuation levels which result in the whole of the main distribution network failing. By creating a situation where virtual islands can be defined as quarantine zones it will be understood that the main distribution network can then be synchronised or re-synchronised repeatedly or at least for short term onward emergency operation without the actual necessity for formation of power islands. It will be understood that actual formation of power islands will necessitate re-synchronisation of the whole of the main distribution network which may be inconvenient and time consuming.

[0034] It will be understood that in addition to utilisation of virtual islanding for maintenance of operation that entering the virtual islanding mode when necessitated by detection of poor network conditions may also initiate operation of electrical power sources which may normally be idle. These generators may be considered emergency generators or back up generators but in any event will add to the flexibility capacity of the overall distributed power generation system. It will be understood in normal operation typically high efficiency is achieved through a limited number of power generators. In such circumstances each large power generator may have a low cost per electrical power unit but a low number of power generators by implication means that relatively large power islands may be created if one generator should fail. In such circumstances for economic operation a relatively small number of power sources may be considered as the main load power sources but should there be detection of poor network transmission conditions or otherwise a number of emergency generators which are normally idle can be brought to operational speed and therefore create a greater flexibility within the main distribution network. In such circumstances all the electrical power sources will then be able to establish their own local group distribution networks or virtual islands, for flexibility purposes. In the above circumstances provided the trigger of poor network conditions occurs then the system will be arranged to enter virtual islanding mode for a sufficient time to elongate the period over which the main distribution network collapses to a gradual change rather than a sudden collapse. In such circumstances the emergency generators have time to reach their synchronising speeds or can be synchronised appropriately and clearly, the controller can then continue with the virtual islanding process by considering local group distribution networks of power sources, whether they be main load or emergency power sources to effectively segment and island the overall main distribution network for quarantining as well as continued operation.

[0035] Generally, switch on and synchronising for an emergency generator utilising a reciprocating engine as a primary mover will take less than 20 seconds. The virtual islanding achieved by methods in accordance with aspects of the present invention and utilisation of a controller in such circumstances will maintain or at least attempt to maintain main